



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B27L 7/00	A2	(11) International Publication Number: WO 97/49531
		(43) International Publication Date: 31 December 1997 (31.12.97)

(21) International Application Number: PCT/NL97/00364

(22) International Filing Date: 27 June 1997 (27.06.97)

(30) Priority Data:
1003451 27 June 1996 (27.06.96) NL

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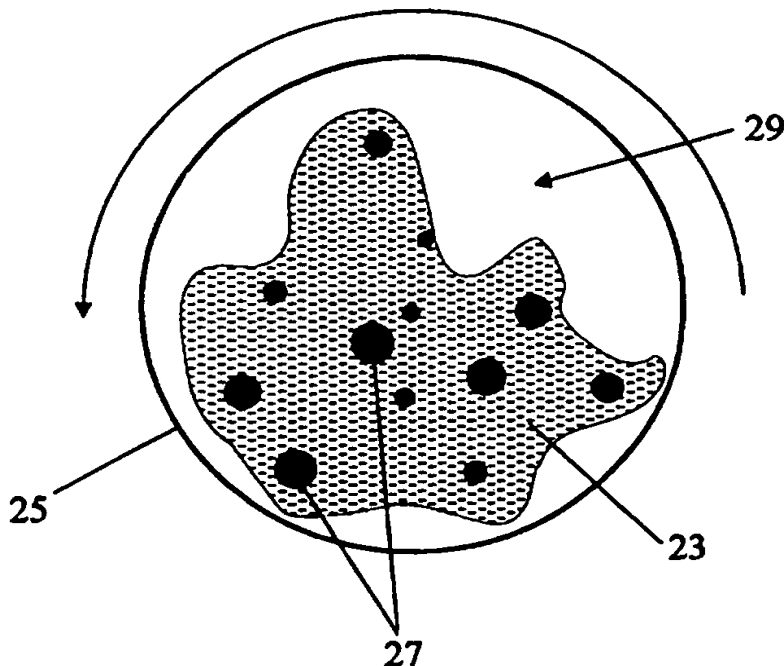
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published*Without international search report and to be republished upon receipt of that report.*

(54) Title: METHOD FOR MANUFACTURING BAMBOO CHIPS AND BAMBOO WOOL, AS WELL AS PRODUCT MANUFACTURED FROM BAMBOO CHIPS AND/OR BAMBOO WOOL

(57) Abstract

In a method for manufacturing bamboo chips, first the nodes are removed from the bamboo culms by sawing through the bamboo culms at each side of a node, and then the bamboo culms are peeled by bringing the bamboo culms on rotating rolls provided with knives. After this the bamboo culms are roughly splitted lengthwise by driving a conical bar through the hollow bamboo culm, and thereafter the splitted pieces are finely chipped. In a method for manufacturing bamboo wool, first the bamboo culms are chipped, then the bamboo chips are introduced in a rotating drum containing balls and steam is added to soften the bamboo chips. By pressing the bamboo wool and/or bamboo chips after adding glue and during heating of the mixture, products like boards or profiles can be obtained.



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Method for manufacturing bamboo chips and bamboo wool, as well as product manufactured from bamboo chips and/or bamboo wool.

5 The invention concerns a method for manufacturing bamboo chips, comprising the steps of roughly splitting lengthwise bamboo culms and thereafter finely chipping the roughly splitted bamboo. Bamboo chips may be used as a basic material for the manufacturing of furniture or building elements. Use of bamboo in stead of wood has a number of great advantages. For instance, it is generally known that bamboo fibres are as
10 strong as steel. Further bamboo grows with great vitality in relatively poor soils all year long, and it is possible to permanently crop from it. This process can be sustained for very long periods of time. Properly managed bamboo plantations can give way to a long term sustainable economic activity that is not harmful to the environment, otherwise as in the case of wood plantations. The productivity of the plant is very high, so there is no need for great
15 extensions of mono cultivation. A further advantage of the use of bamboo instead of wood is that bamboo fibres require far less energy to be extracted, as compared with wood fibres. The main advantage of bamboo, though, is the high quality of bamboo fibres, which are wider and longer than hardwood fibres, fact from where superior quality products can be achieved using the procedures described above.

20 A method as described in the opening paragraph is known from document EP 0 666 155 A1. A disadvantage of this known method is that the quality of the bamboo chips is not optimum.

 It is an object of the present invention to provide a method of the kind described in the opening paragraph, whereby the manufacturing of bamboo chips from
25 bamboo culms is improved. To this end the method according to the present invention is characterized in that, before roughly splitting the bamboo culms first the bamboo culms are peeled. It has been appeared that the material of the peel is of worse quality than that of the culms. By removing the peel from the bamboo culms before further processing the culms into bamboo chips, the quality of the bamboo chips will be improved.

30 The peeling of takes preferably place by bringing the bamboo culms on and/or between rotatings rolls provided with knives or sharp projections.

 The splitting takes preferably place by driving a conical bar through the

hollow bamboo culm. It has been appeared that by this method the bamboo culms split at a great number of places equally distributed along the circumference, so that the desired result is obtained in a simple manner.

5 An embodiment of the method according to the invention is characterized in that, before roughly splitting the bamboo culms the nodes are removed from the bamboo culms. It also has been appeared that the material of the nodes is of worse quality than that of the culms. By also removing the nodes from the bamboo culms before further processing the culms into bamboo chips, the quality of the bamboo chips will be improved further.

10 The removal of the nodes takes preferably place by sawing or cutting through the bamboo culms at each side of or at the place of a node.

To get rid of impurities and dust and/or for preservation purposes the chips are preferably washed. The washing takes preferably place by washing with a borax solution of 1 to 5 %, more preferably with a borax solution of 3 %.

15 The invention further concerns a method for manufacturing bamboo wool, whereby first bamboo culms are chipped into bamboo chips. Bamboo wool has approved to be very suitable for use as raw material for the manufacturing of boards and profiles. The method for manufacturing bamboo wool according to the present invention is characterized in that, the bamboo chips are softened and hammered.

20 The bamboo chips used for this method are preferably manufactured by the aforesaid method according to the present invention.

The softening of bamboo chips takes preferably place by adding steam to the bamboo chips.

The hammering takes preferably place by introducing the bamboo chips in a rotating drum containing balls. By this step the final wool structure will be obtained.

25 Preferably the adding of steam takes place during the aforesaid hammering process by injecting the steam into the drum. By this the softening process will progress better and faster.

30 The invention further concerns a method of manufacturing a product from bamboo chips and/or bamboo wool. The bamboo chips and or bamboo wool used for manufacturing products are preferably obtained by the above described methods according to the present invention. The method for manufacturing products according to the present invention is characterized in that, the bamboo chips and/or wool are dried and after drying

glue is added and the mixture is pressed in a mould.

The bamboo chips and/or wool are preferably dried to a humidity of between 5 to 20%, more preferably to a humidity of between 10 to 12%.

5 Preferably the glue is Urea Formaldehyde and the glue is added in a proportion between 3 to 30% by weight, more preferably between 5 to 20% by weight, depending on the desired strength of the product.

Further the mixture of glue and bamboo chips and/or wool is preferably pressed at a pressure of 10 to 20 Mpa, more preferably at a pressure of about 15 Mpa, for the polymerization of the glue.

10 To improve the polymerization of the glue, the mixture of glue and bamboo chips and/or wool is heated at a temperature between 80 and 120 degrees Celcius, preferably between 90 and 110 degrees Celcius.

The invention further concerns bamboo chips and wool and products manufactured according to the above described methods.

15 The invention will be elucidated more fully below by means of drawings in which examples of the methods and products according to the invention are shown. Herein shows:

Figure 1 a part of a cut off bamboo culm;

Figure 2 the sawing through of the bamboo culm;

20 Figure 3 the peeling of the bamboo culm;

Figure 4 the roughly splitting of the bamboo culm;

Figure 5 the finely cutting into bamboo chips;

Figure 6 products manufactured from bamboo;

Figure 7 the processing of bamboo chips into bamboo wool; and

25 Figure 8 a product manufactured from bamboo wool.

Figure 1 shows a cutted trough bamboo culm 1. As clearly appears, the bamboo culms are hollow and have nodes 3 at distances from each other in the lengthwise direction. The culms have bamboo fibres 5 which extend in the lengthwise direction of the bamboo culm. The bamboo culms are proposed to be brought for production when ripe and before the process of drying starts. The culms are harvested preferably between three and 30 four and a half years old. Preferably those are used that have a culm diameter of 10 cm and above and wall thickness of 6 mm and above.

In the first step, as shown in figure 2, the bamboo culms 1 are sawed into pieces of more or less equal lengths by means of a circular saw 7 with vertical movement. The bamboo culms 1 are moved intermittent under the saw 7 by rolls 9. During this process also the nodes 3 are removed by sawing through the culms close to and at each side of a node or at the place of a node.

The second step comprises the elimination of the external cuticular 11 of the bamboo culm 1. The peel is eliminated, as is shown in figure 3, by high speed rotation of rolls 13 provided with knives or sharp projections (not shown in the figure) on which the bamboo culm 1 is brought to rest. The peeling will take only a few seconds in this way. At this stage the culms are ready for further processing, but they must keep their natural humidity content.

The third step comprises the splitting of the culms, as is shown in figure 4. This operation is carried out by introducing a slightly conical bar (not shown in the figure) inside the bamboo culm 1. The conical bar hereby introduces radial forces on the wall of the bamboo culm (see arrows in the figure) by which the culm splits in a number of longitudinal pieces 15.

In the fourth step these longitudinal pieces 15 are inserted in a machine 17, which process them into small bamboo chips 19 in a known manner, see figure 5. These bamboo chips 19 are preferably of a maximum size of 3 mm, and are the raw basic material for the manufacturing of boards 21 and solid profiles 23, see figure 6. After this the bamboo chips are washed with a 3% borax solution to get rid of impurities and for preservation purposes.

In stead of using bamboo chips as a basic material for manufacturing of boards and profiles, the bamboo chips may be processed first to bamboo wool, which wool then may be used as a basic material. Hereto the bamboo chips 23, preferably of a length between 1 and 3 cm, are inserted in a rotating drum 25 containing steel balls 27, as shown in figure 7. In this drum 25 steam 29 is injected. This is a process of softening, in order to free the small fibres from the surrounding biomass, mainly lignins. The bamboo fibres are thereafter separated by further washing and screening, from where a sort of wool is produced.

For further processing the bamboo chips and/or bamboo wool are dried to a humidity content of between 10 to 12%. After drying the bamboo chips and/or bamboo

wool are mixed with an agglutinant, Urea Formaldehyde, in a proportion between 5 to 20% by weight depending on the desired strength. After this the mixture is mold pressed, under conditions that depend on the specification of the final desired product. For instance at a pressure of 15 MPa and a temperature between 90 to 100 degrees Celsius and during a time of 5 minutes. By this way, a medium density bamboo board is produced, to desired dimensions, as is shown in figure 6. Depending on the final use of the product, several glue types can be used, and the type of glue defines whether hot or cold pressing will be necessary. In any case, the mixture is set in molds and processed.

Also, in this way building profiles from bamboo wool can be manufactured. Figure 8 shows such a building profile 31. Because of their strength bamboo wool can also be used to manufacture reinforcement profiles, like bars 33 as is shown in figure 8. It will be apparent that profiles with many different cross-sections can be obtained in this way.

Although the invention has been elucidated in the foregoing by means of drawings, it should be established that the invention in no way is limited to the embodiments shown in the drawings. The invention applies to all embodiments deviating from the embodiments shown in the drawings within the framework defined by the claims. Instead of splitting the bamboo culm by driving a conical bar into the bamboo culm, this splitting can also take place by compressing the bamboo culm in a transversal direction (opposite to the direction shown in figure 4 by means of the arrow). To manufacture the bamboo wool, it is also possible to use stones or other heavy objects in the rotating drum instead of steel balls.

CLAIMS:

1. Method for manufacturing bamboo chips, comprising the steps of roughly splitting lengthwise bamboo culms and thereafter finely chipping the roughly splitted bamboo, characterized in that, before roughly splitting the bamboo culms first the bamboo culms are peeled.
2. Method according to claim 1, characterized in that, the peeling takes place by bringing the bamboo culms on and/or between rotating rolls provided with knives or sharp projections.
3. Method according to claim 1 or 2, characterized in that, the splitting takes place by driving a conical bar through the hollow bamboo culm.
4. Method according to claim 1, 2 or 3 characterized in that, before roughly splitting the bamboo culms the nodes are removed from the bamboo culms.
5. Method according to claim 4, characterized in that, the removing of the nodes takes place by sawing or cutting through the bamboo culms at each side of or at the place of a node.
6. Method according to claim 1, 2, 3, 4 or 5, characterized in that, after chipping the bamboo the chips are washed.
7. Method according to claim 6, characterized in that, the washing takes place by washing with a borax solution of 1 to 5 %.
8. Method according to claim 7, characterized in that, the washing takes place by washing with a borax solution of 3 %.
9. Method for manufacturing bamboo wool, whereby first bamboo culms are chipped into bamboo chips, characterized in that, the bamboo chips are softened and hammered.
10. Method according to claim 9, characterized in that, the softening and hammering takes place at the same time.
11. Method according to claim 9 or 10, characterized in that, the softening of bamboo chips takes place by adding steam to the bamboo chips.
12. Method according to claim 9, 10 or 11, characterized in that, the hammering takes place by introducing the bamboo chips in a rotating drum containing balls.
13. Method according to claim 9, 10, 11 or 12, characterized in that, the making of bamboo chips from bamboo culms takes place by a method according to one of the

preceeding claims 1 up to and including 8.

14. Bamboo chips manufactured by a method according to one of the claims 1 up to and including 8.

15. Bamboo wool manufactured by a method according to one of the claims 9 up to and including 13.

16. Method of manufacturing a product from bamboo chips and/or bamboo wool, characterized in that, the bamboo chips and/or wool are dried and after drying glue is added and the mixture is pressed in a mould.

17. Method according to claim 16, characterized in that, the bamboo chips and/or wool are dried to a humidity of between 5 to 20%.

18. Method according to claim 17, characterized in that, the bamboo chips and/or wool are dried to a humidity of between 10 to 12%.

19. Method according to claim 16, 17 or 18, characterized in that, the glue is Urea Formaldehyde.

20. Method according to claim 16, 17, 18 or 19, characterized in that, the glue is added in a proportion between 3 to 30% by weight.

21. Method according to claim 20, characterized in that, the glue is added in a proportion between 5 to 20% by weight.

22. Method according to claim 16, 17, 18, 19, 20 or 21, characterized in that, the mixture of glue and bamboo chips and/or wool is pressed at a pressure of 10 to 20 MPa.

23. Method according to claim 22, characterized in that, the mixture of glue and bamboo chips and/or wool is pressed at a pressure of about 15 MPa.

24. Method according to claim 22 or 23, characterized in that, the mixture of glue and bamboo chips and/or wool is heated at a temperature between 80 and 120 degrees Celcius.

25. Method according to claim 24, characterized in that, the mixture of glue and bamboo chips and/or wool is heated at a temperature between 90 and 110 degrees Celcius.

26. Method according to one of the preceeding claims 16 up to and including 25, characterized in that, the bamboo chips and or bamboo wool are obtained by a method according to one of the preceeding claims 1 up to and including 13.

27. Product manufactured by a method according to one of the claims 16 up to and including 26.

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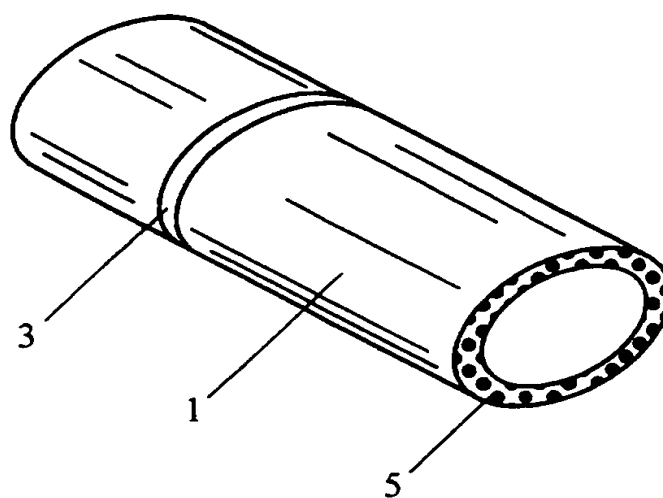


FIG. 1

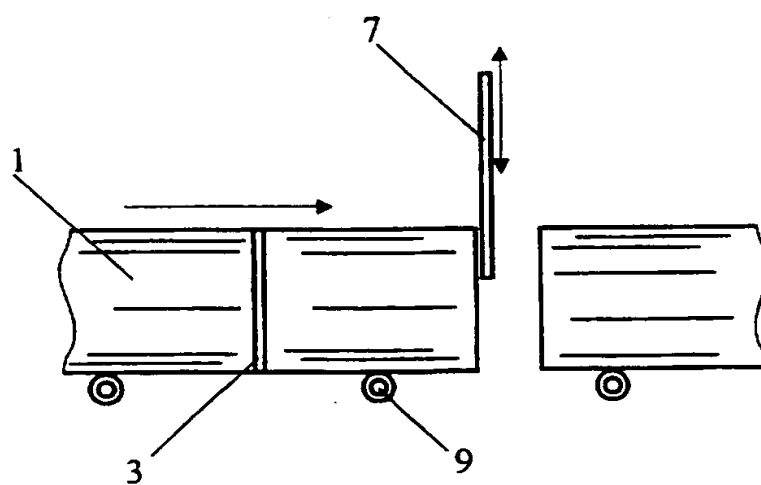


FIG. 2

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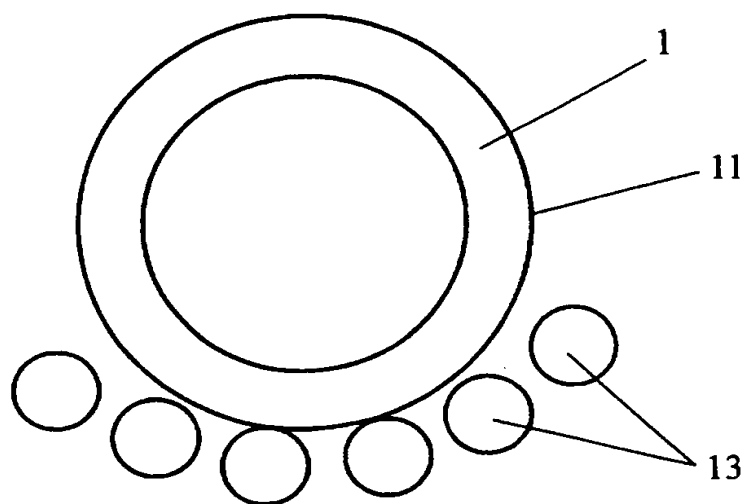


FIG. 3

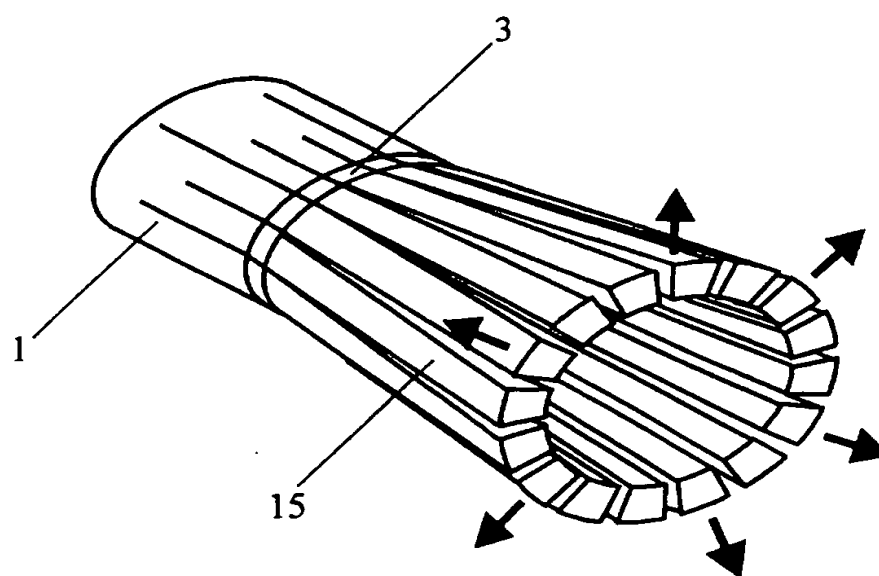


FIG. 4

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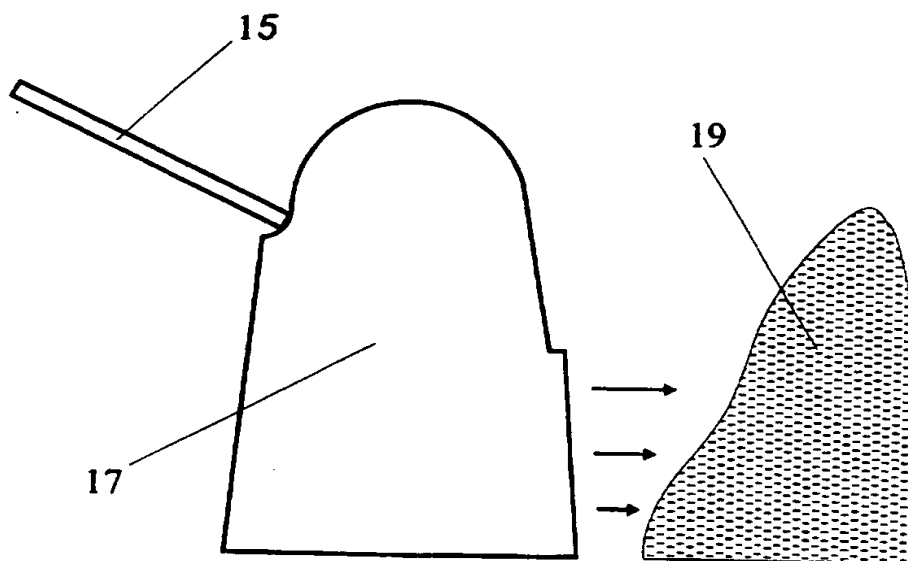


FIG. 5

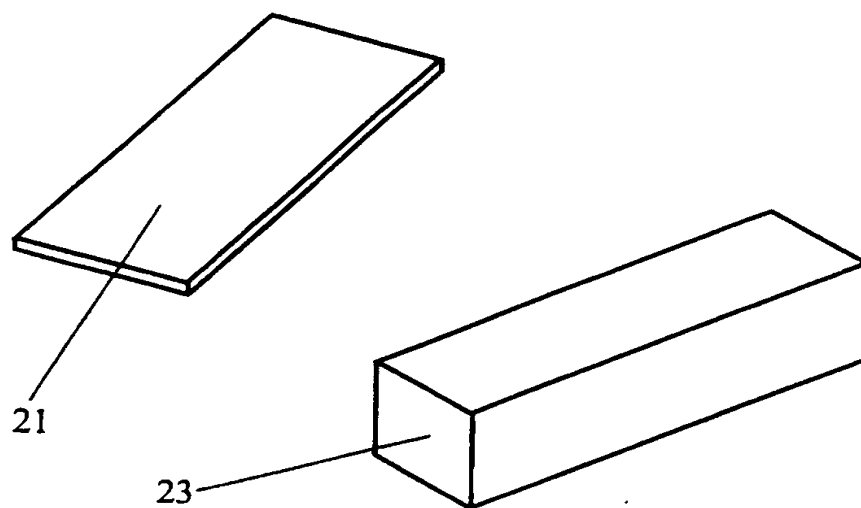


FIG. 6

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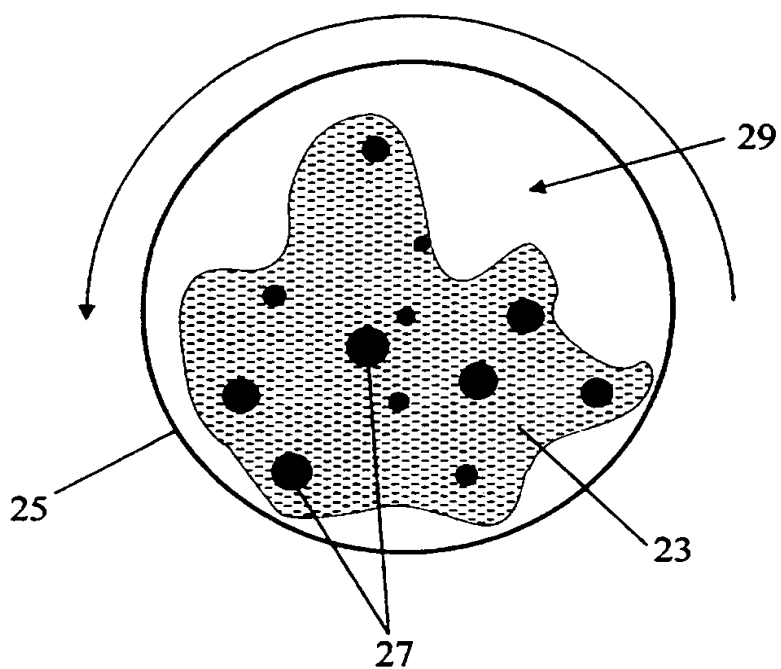


FIG. 7

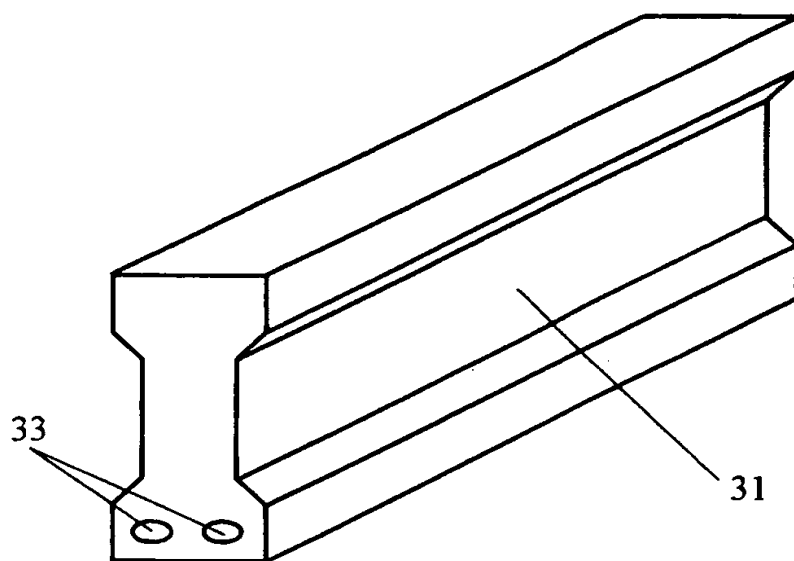
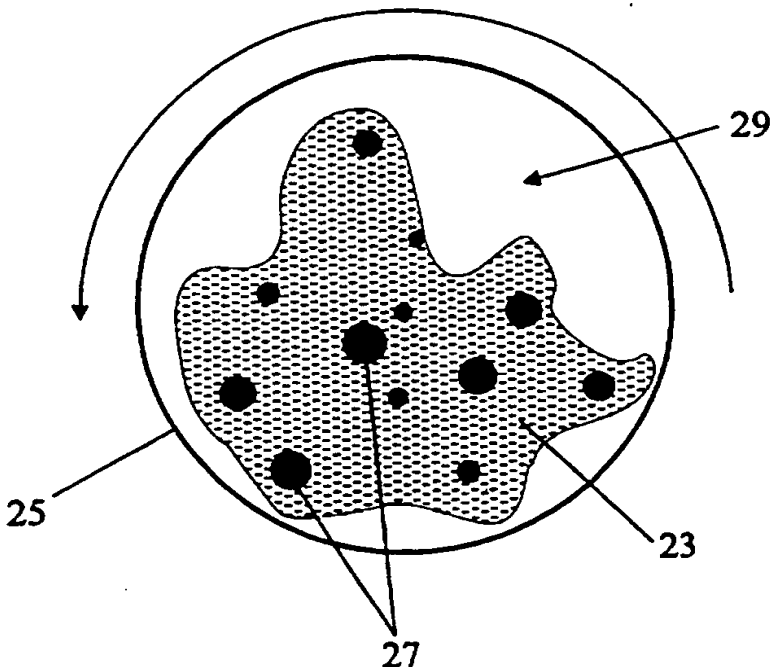


FIG. 8



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(51) International Patent Classification ⁶ : B27N 3/00, 5/00, B27K 9/00, B27J 1/00, B27L 11/02, 11/04	A3	(11) International Publication Number: WO 97/49531 (43) International Publication Date: 31 December 1997 (31.12.97)
(21) International Application Number: PCT/NL97/00364 (22) International Filing Date: 27 June 1997 (27.06.97) (30) Priority Data: 1003451 27 June 1996 (27.06.96) NL (71)(72) Applicant and Inventor: VEKEMANS, Henricus, Jo- hannes [NL/NL]; Kruiningenstraat 53, NL-5045 PS Tilburg (NL). (72) Inventor; and (75) Inventor/Applicant (for US only): ARCE-VILLALOBOS, Os- car Antonio [CR/CR]; P.O. Box 8225-1000, San José (CR). (74) Agent: VERHEES, Godefridus, Josephus, Maria; Brabants Octrooibureau, De Pinckart 54, NL-5674 CC Nuenen (NL).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims</i> <i>and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 9 April 1998 (09.04.98)
(54) Title: METHOD FOR MANUFACTURING BAMBOO CHIPS AND BAMBOO WOOL, AS WELL AS PRODUCT MANUFAC- TURED FROM BAMBOO CHIPS AND/OR BAMBOO WOOL		
(57) Abstract In a method for manufacturing bamboo chips, first the nodes may be removed from the bamboo culms by sawing through the bamboo culms at each side of a node, and then the bamboo culms are peeled preferably by bringing the bamboo culms on rotating rolls provided with knives. After this the bamboo culms are roughly splitted lengthwise preferably by driving a conical bar through the hollow bamboo culm, and thereafter the splitted pieces are finely chipped. In a method for manufacturing bamboo wool, first the bamboo culms are chipped, then the bamboo chips are preferably introduced in a rotating drum (25) containing balls (27) and steam (29) is added to soften the bamboo chips. By pressing the bamboo wool and/or bamboo chips after adding glue and during heating of the mixture, products like boards or profiles (31) can be obtained.		



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INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 97/00364

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B27N3/00 B27N5/00 B27K9/00 B27J1/00 B27L11/02
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B. FIELDS SEARCHED

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IPC 6 B27J B27N B27K B27L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 708 (C-1147), 24 December 1993 & JP 05 239791 A (TOOTARU IN:KK), 17 September 1993, see abstract	1,6,14
X	---	9,10,15
A	PATENT ABSTRACTS OF JAPAN vol. 016, no. 438 (M-1309), 11 September 1992 & JP 04 151202 A (GIKEN NAISOU:KK), 25 May 1992, see abstract	1

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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 126 493 A (MILLER) 5 September 1968 see page 1, line 9 - line 12 see page 2, line 128 - page 3, line 31; figures 1-10 ---	1
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 001, 28 February 1995 & JP 06 293008 A (FUYO KOGYO KK), 21 October 1994, see abstract ---	
A	US 1 713 683 A (WENSEL) 21 May 1929 ---	
A	WO 96 09921 A (CHAN SHUI FONG) 4 April 1996 -----	

INTERNATIONAL SEARCH REPORT

I. International application No.

PCT/NL 97/ 00364

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

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3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-15, 26: Methods for manufacturing peeled bamboo chips or bamboo wool and products of the said methods.
2. Claims 16-25, 27: Method for manufacturing products from bamboo chips and bamboo wool

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-15, 26

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 97/00364

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